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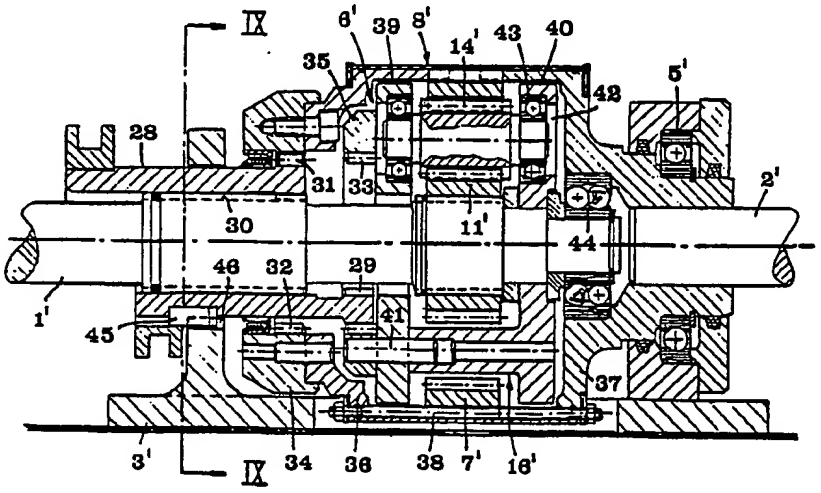

(57) Abstract

In a reversing gear mechanism a planetary gearing (6′) is arranged between an input and an output shaft (1′ 2′) including an internally toothed gear (7′) in a housing (8′) a sun-wheel (11′) torsionally rigidly connected to the input shaft (1′) and a plurality of planetary wheels (14′), located between the sun-wheel and the gear, and arranged on a common carrier cooperating with an axially movable control sleeve (28). This control sleeve has as its purpose to, in a first axial position, cause a torsionally rigid connection between the shafts (1′, 2′) so that these jointly rotate in a first rotational direction, and in a second axial position, brake the planetary wheel carrier (16′) to a stationary position in which the rotational movement of the input shaft (1′) is transmitted to the output shaft (2′) by means of the sun-wheel (11′) the planetary wheels (14′) the gear (7) and the housing (8′), the planetary gears in said second adjustment position causing, on one hand, a reversal of the rotational direction of the input shaft to an opposite rotational direction of the output shaft and, on the other hand, a reduction of the rotational speed of the last mentioned shaft.

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REVERSING GEAR MECHANISM

Technical field of the invention

This invention relates to a reversing gear mechanism including an input shaft and an output shaft arranged in line after each other.

Background to the invention

Many types of snow-mobiles entirely lack any kind of reversing gear and can for this reason only be driven in a forward direction. This is especially unsatisfactorily in heavy snow-mobiles, that are extremely difficult to move backwards manually, for instance out from a garage or from a position stuck in a snow drift or a ditch. It is true that there are reversing gears available that per se could be mounted also in snow-mobiles. Previous reversing gears of this kind are however on one hand very expensive, and on the other hand difficult to subsequently fit into existing snow-mobiles in that they need a comparatively big space.

Short description of the inventive concept

The present invention aims to create a reversing gear mechanism that is especially suited for snow-mobiles, and on one hand is cheap and on the other hand is compact in size, so that it can without difficulty be fitted also in small spaces. In accordance with the invention this is attained by the fact that a planetary gearing is arranged between the two shafts, said gearing comprising an internally toothed gear arranged on a housing bridging the space between the two shafts, a sun wheel rotating with the input shaft and a plurality of planetary wheels placed between the sun wheel and said gear and arranged on a common carrier co-operating with an axially movable control sleeve having the purpose to on one hand, in a first axial position, cause a torsionally rigid connection between the shafts so that these jointly rotate in a first

rotational direction, and on the other hand, in a second axial position, break the planetary wheel carrier to a stationary position in which the rotation of the input shaft is transmitted to the output shaft by means of the sun wheel, the planetary wheels, the gear wheel and the housing, the planetary wheels in said second adjustment position causing on one hand a reversion of the rotational direction of the input shaft to an opposite rotational direction of the output shaft, and on the other hand a reduction of the rotational speed of the last-mentioned shaft.

The mechanism according to the invention may in a simple way be fitted into the drive of snow-mobiles just by cutting of the shaft, normally existing in this kind of drive, between the motor and the tracks, thereby forming said input shaft and said output shaft between which the planetary gearing is applied.

Short description of the attached drawings

In the drawings Fig 1 is a longitudinal section of a first embodiment of the mechanism according to the invention in a first functional position, Fig 2 a cross-section II-II in Fig 1, Fig 3 a longitudinal section of the mechanism in a second functional position, Fig 4 a cross-section IV-IV in Fig 3, Fig 5 a longitudinal section of the mechanism in a third functional position and Fig 6 a cross-section VI-VI in Fig 5, Fig 7 a longitudinal section of an alternative, further developed embodiment of the invention, the upper half of the drawing showing the mechanism in a forwardly driving position and the other half the same mechanism in a reversal position, Fig 8 an overhead view of the same mechanism, Fig 9 a cross-section IX-IX in Fig 6 and Fig 10 a longitudinal section of a further embodiment.

Detailed description of a preferred embodiment of the invention

In Fig 1-6, 1 designates an input shaft that in practice is imagined to be continuously rotatable in the direction of the arrow A, for instance by being connected to the motor in a snow-mobile. 2 designates an output shaft which in turn is imagined to be connected to the tracks or chains of a snow-mobile by means of suitable transmissions. In the example shown the two shafts are included in a demonstration model developed only for illustrative purposes and having two bearings 4,5, of an optional kind, mounted on a stand 3.

A planetary gearing generally designated 6, is arranged between the two shafts 1,2 comprising a ring-shaped, internally toothed gear 7 arranged on the inner side of a housing 8 having at one end a sleeve-formed part 26 being connected to the output shaft 2 by means of a first splined coupling comprising external splines 9 on the shaft 2, and internal splines 10 on the inside of the sleeve part 26. The gearing 6 further includes a sun-wheel 11 (see Fig 2) that, by means of a second splined coupling comprising external splines 12 on the shaft 1 and internal splines 13 in a through hole in the sun-wheel 11, is torsionally rigidly connected to but in this case axially movable relative to the input shaft 1. A plurality of planetary wheels 14,14A,14B are arranged between teh sun-wheel 11 and the gear 7 that each are rotatably journalled around pins 15 being arranged to rotate with a common wheel carrier 16 being rotatable relative to the shaft 1 as well as to the housing 8. It should however be noted that the wheel carrier 16 is locked relative to the housing 8 by means of a circlip (Seeger-ring) or similar means 17, that ensures that the wheel carrier always accompanies the housing in its axial movements.

In similarity with the housing 8, the wheel carrier 16 also is transformed into a sleeve-formed part 27, on the free end of which a collar-formed disc 21 is attached. This disc is situated between a fixed jaw 22 and a curve-formed jaw 23 being swingably movable in a sutable way, in this case by means of a lever 24.

A helical compression spring 25 is arranged between the axially movable housing 8 and the bearing device 5, said spring always striving to move the housing in a direction towards the right in the drawings.

The function of the invention

The housing 8 is in a first axial position of adjustment during normal propulsion, for instance when propelling a snow-mobile in a forward direction, wherein the spring 25 automatically keeps the housing towards the right in Fig 1. In this position the external splines 12 on the input shaft 1 engage the sleeve part 26 of the housing and are, together with the external splines of the output shaft 2, in engagement with the internal splines 10 in said sleeve part. By these means a direct mechanical coupling of the shafts 1 and 2 are caused so that these rotate in the same direction and with exactly the same rotational speed.

In the condition shown in Fig 3 the lever 24 has manually been swung a distance anticlockwise moving the sleeve part 27, and thereby the housing 8 in its entirety, a distance towards the left, against the action of the spring 25. More specifically the housing has been moved so far towards the left that the splines 12 of the input shaft 1 have been disengaged from the analogous splines 10 on the inner side of the sleeve part 26. By these means not only the sun-wheel 11, but also the planetary wheels 14,14A,14B engaged with this, are brought into

rotation around their shafts. The rotation of the planetary wheels does not show in any other way than that they will move along the inside of the housing 8 without carrying the housing along. In other words the output shaft 2 will be stationary in spite of a continued rotation of the input shaft 1.

In the condition shown in Fig 5 the lever 24 has been moved so far anticlockwise that the collar 21 is clamped between the jaws 22 and 23, whereby the sleeve part 27 and thus the wheel carrier 16 itself, will be held in a stationary position. In this condition the continued rotation of the input shaft 1 will rotate the sun-wheel 11 bringing the planetary wheels 14 into rotation around the pins 15. Since these now are stationary, the rotation of the planetary wheels will show in a rotation of the housing 8 and the output shaft 2 which is torsionally rigidly connected thereto by means of the splined coupling 9,10. More specifically the housing and the output shaft will be driven in a rotational direction opposite to the input shaft 1 (see the arrow B in Fig 5), and with a rotational speed that is only one third of the rotational speed of the input shaft. In other words a reversal of the rotational direction of the input shaft as well as a reduction of the rotational speed of the output shaft are simultaneously obtained.

Detailed description of a further developed embodiment of the invention

Figs 7-9 illustrate a further developed embodiment of the mechanism according to the invention being adapted to production. It should be noted that Fig 7, in one and the same drawing, illustrates two different functional positions, namely a forwardly driving position shown above the dash-dotted horizontal central line through the drawing, and a reversal position shown below said central line.

In conformity with the embodiment according to Figs 1-6 the mechanism shown in Fig 7-9 includes an input shaft 1', an output shaft 2' and a stand 3' having a bearing 5' for the journalling of the output shaft 2'. The input shaft 1' is in this case imagined to be journalled in a bearing (not shown) disposed at a distance from the mechanism. The mechanism further includes a planetary gearing 6' and an internally toothed gear 7' arranged on the inner side of a housing 8' to which the output shaft 2' is torsionally rigidly connected. A sunwheel 11' is torsionally rigidly connected to the input shaft 1', and by means of usual cogs connected to the corresponding cogs of a number of planetary wheels 14', whose number, in this case as well, can be three. These planetary wheels are arranged on a wheel carrier in its entirety designated 16'.

On the outside of the input shaft 1' an axially movable control sleeve 28 is arranged having internal splines 29 arranged to cooperate with external splines 30 on the shaft 1. It should be noted that the splines 30 are comparatively long whilst the splines 29 have a short axial extent. The sleeve 28 further has external, rather short splines 31 arranged to cooperate with either one of two axially separated sets of splines 32,33, namely a first set of splines 32 arranged on a ring 34 forming part of the housing 8', and a second set of splines 33 arranged on a ring 35 forming part of and following the wheel carrier 16'.

In the example shown, the housing 8' is composed of two halves 36,37 being held together by a large number of radially separated bolts 38. By this division of the housing the mounting respective demounting of the housing is facilitated. In a similar way the planetary wheel carrier 16' is also composed of two halves 39,40. These halves

are in the form of discs separated from each other and held together by means of bolts 41. These bolts also hold the ring 35. Recesses 42 are arranged in the two discs 39, 40 for bearing 43 wherein the planetary wheels 14' are journalled.

It should also be noted that the input shaft 1 is journalled relative to the housing 8', namely by means of the bearing 44.

On the outside of the control sleeve 28 there is a wedge 45 arranged to engage a corresponding recess 46 in the stationary stand 3'.

The reversing mechanism shown in Figs 7-9 functions in the following way: In the forwardly driving position shown in the upper half of Fig 7 the control sleeve 28 is pushed outwards to an outer end position, wherein the splines 29 are in engagement with the splines 30 on the shaft 1', at the same time as the external splines 31 are in engagement with the internal splines 32 of the housing 8'. In this position the rotational movement of the input shaft 1' is transmitted to the output shaft 2' by means of the control sleeve and the housing; this means that the output shaft is driven with exactly the same rotational speed and in the same rotational direction as the input shaft.

When the desire is to reverse the rotational direction of the output shaft 2' and, at the same time, obtain a reduction of the rotational speed, the control sleeve 28 is pushed inwards to the inner end position shown in the lower part of Fig 7. In this connection the wedge 45 engages the recess 46, which means that the sleeve is kept in a stationary condition. At the same time the external splines of the sleeve are released from their engagement

with the housing and instead engage the internal splines 33 of the planetary wheel carrier 16'. This results in that the planetary wheel carrier is forced to stop. When therefore the sun wheel 11' continues to rotate as a consequence of its connection to the input shaft 1', the planetary wheels will bring the housing 8 into rotation, now in the opposite rotational direction compared with the earlier described functional condition. In other words the shaft 2' will also be driven with a reversed rotational direction and a reduced rotational speed.

In the embodiment shown in Figs 7-9 as well, the mechanism can be shifted into a free-wheeling position. This is done by moving the control sleeve 28 inwards only so far that the splines 31 are located in the area between the two separated sets of splines 32 and 33 of the housing respectively the planetary wheel carrier.

Fig 10 shows an embodiment wherein the mechanism according to the invention has been built into an automatic V-belt transmission, one grooved pulley of which being designated 47. This groove pulley, which is arranged on the shaft 2', includes a fixed and a movable half 48 and 49 respectively, the last mentioned one of which is influenced by a spring 50 always striving to move the halves towards each other and against the action of which the halves can be separated from each other in a conventional way at increasing rotational speeds, changing the diameter of the V-belt. In an alternative embodiment, that has not been illustrated, the reversing mechanism is arranged with the housing 8' in the centre of the grooved pulley 47 so that this pulley is driven directly by the housing 8', possibly by means of a bearing in the form of a sleeve, whereon the half 49 of the grooved pulley can glide, and cooperating with the housing by means of splines.

Conceivable modifications of the invention

The invention is of course not limited only the embodiment as described and shown in the drawings. Thus it is for instance conceivable to fit the mechanism with a plurality of consecutive sets of planetary wheels in order to obtain an extremely large gear ratio between the two shafts. The location and the dimensions of the splines in question can be varied within wide limits, it is also conceivable to replace the splines in question with other elements of the male-female kind.

CLAIMS

1. Reversing gear mechanism including an input and an output shaft arranged in line after each other, c h a r a c t e r i s e d i n that between the two shafts(1,2) a planetary gear(6) is arranged, including an internally toothed gear(7) arranged on a housing(8) bridging the space between the two shafts, a sun-wheel (11) torsionally rigidly connected to the input shaft (1) and a plurality of planetary wheels(14) which are arranged between said sun-wheel(11) and said gear(7) arranged on a common carrier(16) cooperating with an axially movable control sleeve(27,28) having the purpose to on one hand, in a first axial position, cause a torsionally rigid connection between the shafts(1,2) so that these jointly rotate in a first rotational direction, and on the other hand, in a second axial position, break the planetary wheel carrier(16) to a stationary position in which the rotary movement of the input shaft is transmitted to the output shaft by means of the sun-wheel(11), the planetary wheels(14), the gear(7) and the housing(8), the planetary wheels in said second adjustment position causing, on one hand, a reversal of the rotational direction of the output shaft, and on the other hand, a reduction of the rotational speed of the last mentioned shaft.

2. Reversing gear mechanism according to claim 1, c h a r a c t e r i s e d i n that the control sleeve (27,28) is adjustable into a medial position located between said first and said second positions of adjustment, the planetary wheel carrier(16) in said medial position being free to rotate at the same time as the shafts(1,2) have no torsionally rigid connection with each other, whereby the input shaft(1) can be continuously driven without carrying the output shaft(2) along in either of the rotational directions.

3. Reversing gear mechanism according to claim 1 or 2, c h a r a c t e r i s e d i n that the control sleeve (28) has internal splines(29) for engagement with corresponding external splines(30) on the input shaft(1') as well as external splines(31) for alternative engagement with two sets of internal splines(32,33), namely on one hand a first set of splines(32) on the housing(8') to which the output shaft(2) is torsionally rigidly connected, and on the other hand a second set of splines(33) arranged on the wheel-carrier(16'), said sets being axially separated from each other.

4. Reversing gear mechanism according to claim 3, c h a r a c t e r i s e d i n that the control sleeve (28) has a wedge(45) arranged to engage a recess(46) of a stationary stand(3') when the external set of splines (31) of the sleeve is moved into engagement with the internal set of splines(33) of the planetary wheel carrier(16').

5. Reversing gear mechanism according to anyone of the preceding claims, c h a r a c t e r i s e d i n that the planetary wheel carrier(16') includes two discs (39,40) which are axially separated and mutually connected and between which the planetary wheels(14') extend, said wheels journalled in bearings(43) located in recesses (42) in the discs(39,40).

6. Reversing gear mechanism according to claim 1 or 2, c h a r a c t e r i s e d i n that the housing(8) is connected to the output shaft(2) by means of a first splined coupling(9,10) allowing an axial movement of the housing whilst maintaining a torsionally rigid engagement with the output shaft, and in that the sun-wheel(11) is axially moveable relative to the input shaft(1) by means of a second spline coupling(12,13).

7. Reversing gear mechanism according to claim 6, c h a r a c t e r i s e d i n that the housing(8) is arranged to follow the control sleeve in its axial movements and that a spring(25), for instance a helical compression spring, always strives to move the housing to said first position of adjustment, the housing being movable to its other position of adjustment against the action of said spring.

8. Reversing gear mechanism according to anyone of the preceding claims, c h a r a c t e r i s e d i n that it is built into an automatic V-belt transmission(47).

9. Reversing gear mechanism according to anyone of the preceding claims, c h a r a c t e r i s e d i n that the mechanism is fitted into the centre of a grooved pulley(47), included in an automatic V-belt transmission, in a way that the wheel(47) is arranged on the outside of and driven by the housing(8').

AMENDED CLAIMS

[received by the International Bureau on 03 October 1986 (03.10.86); original claims 1–9 replaced by new claims 1–4 (2 pages)]

CLAIMS

1. Reversing gear mechanism including an input and an output shaft(1,2) arranged in line after each other, said two shafts being connected to each other by means of a planetary gear(6) including on one hand an internally toothed gear (7) arranged on a housing(8) and, on the other hand, a sun-wheel(11) being torsionally rigidly connected to the input shaft(1),and a plurality of planetary wheels(14) engaging the sun-wheel as well as the internally toothed gear(7) and being arranged on a carrier(16) that is freely rotatable in relation to the input shaft(1) as well as to the housing(8), c h a r a c t e r i z e d in that the housing(8) is connected to the output shaft(2) by means of a first splined coupling (9,10) allowing an axial displacement of the housing whilst retaining an torsionally rigid connection to the output shaft, that the carrier(16) is axially united to and movable with the housing(8), and that the input shaft also is provided with splines(12), by which means the housing(8) on one hand in a first position of adjustment, effects a torsionally rigid connection between the shafts(1,2) in that the external splines(9,12) of the shafts simultaneously engage the internal splines(10) of the housing, and, on the other hand, in a second axial position of adjustment, is disengaged from the input shaft at the same time that the planetary wheel carrier (16) is braked in relation to the input shaft(1), thus,by means of the sun-wheel(11) and the planetary wheels(14) setting the housing(8), and thus also the output shaft(2) connected thereto by means of said first splined coupling(9,10), into rotation in a direction that is opposite to the rotational direction of the input shaft(1) and with a rotational speed that is reduced in relation to the rotational speed of said input shaft.

2. Reversing gear mechanism according to claim 1, c h a r a c t e r i z e d in that the housing is movable into an intermediate position wherein the input shaft(1) is disengaged from said first splined coupling(10) and wherein the planetary wheels can be driven by the sun-wheel without

simultaneously driving the housing, by which means the input shaft can be continously driven without the output shaft being simultaneously rotated.

3. Reversing gear mechanism according to claim 1 or 2, c h a r a c t e r i z e d in that a spring(25), for instance a helical compression spring, always strives to move the housing towards said first position of adjustment, the housing being movable into its second position of adjustment against the action of said spring, for instance by means of a swingable clamping jaw arranged to be able to clamp a part(21) being fixedly attached to the wheel-carrier(16) against a fixed jaw(22).

4. Reversing gear mechanism according to any one of the preceding claims, c h a r a c t e r i z e d in that the sun-wheel(11) is axially movable in relation to the input shaft(1) by means of a second splined coupling(12,13).

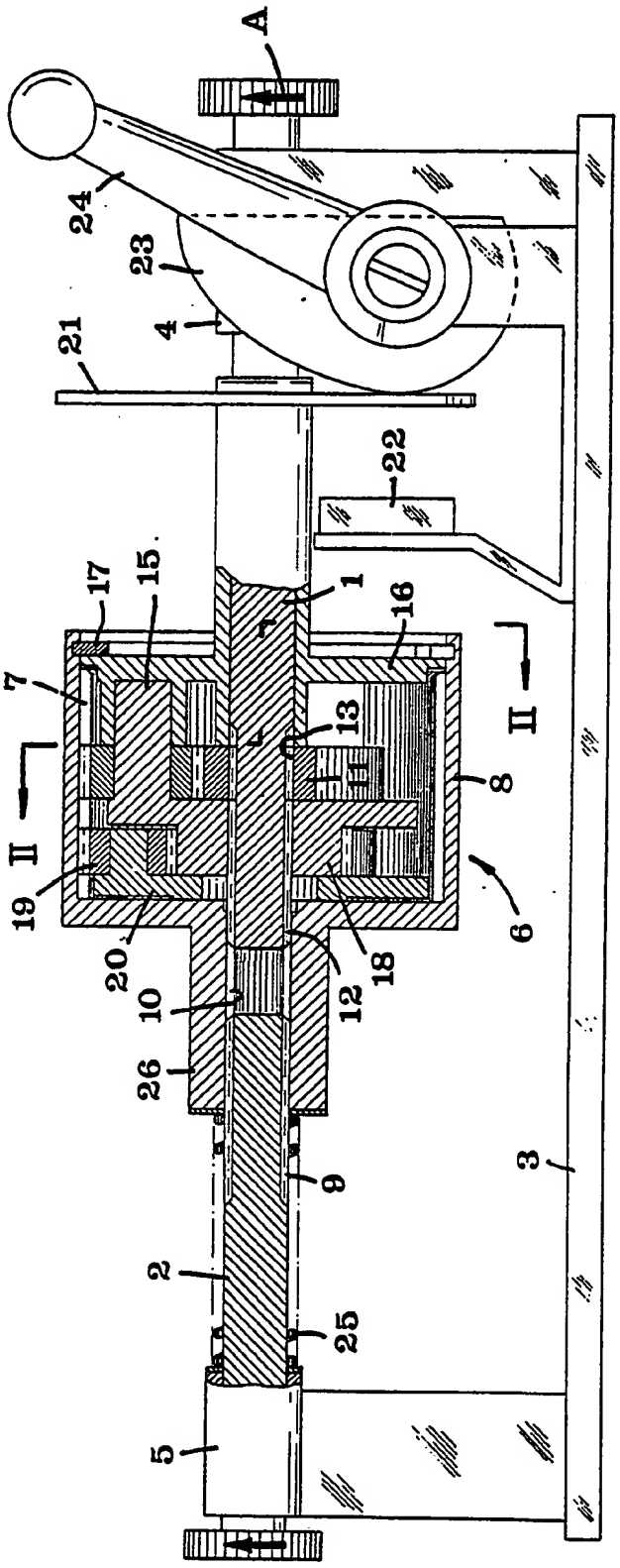
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Fig 1

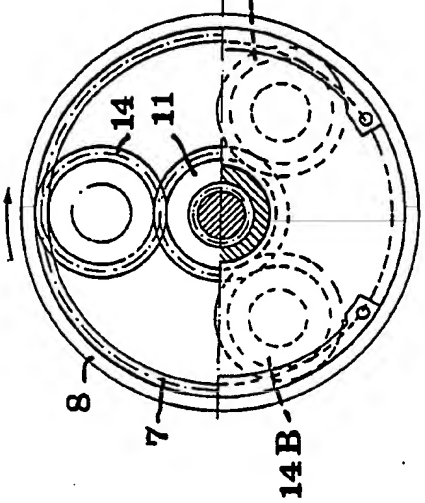

14A
14
11
8
7
14B

Fig 2

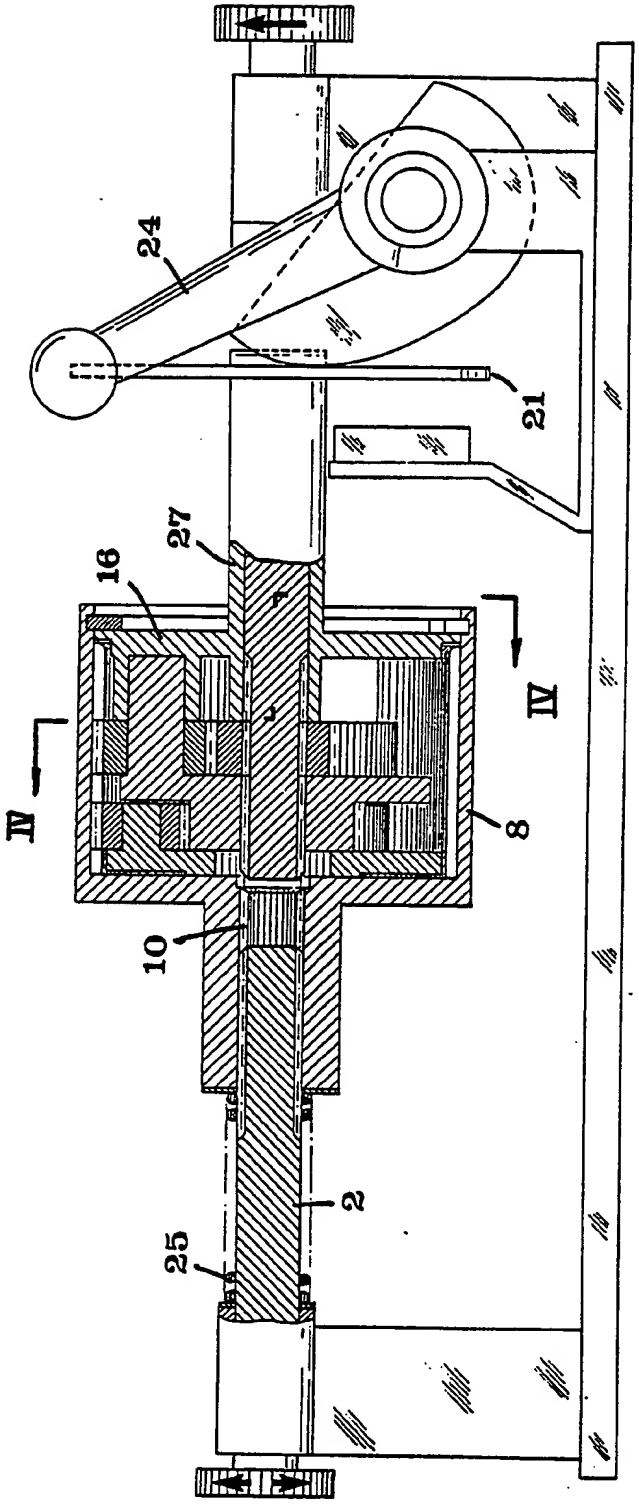


Fig 3

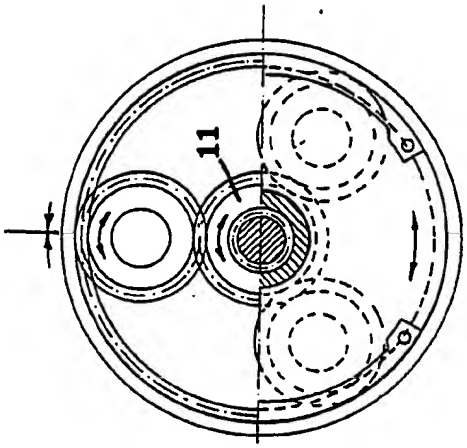


Fig 4

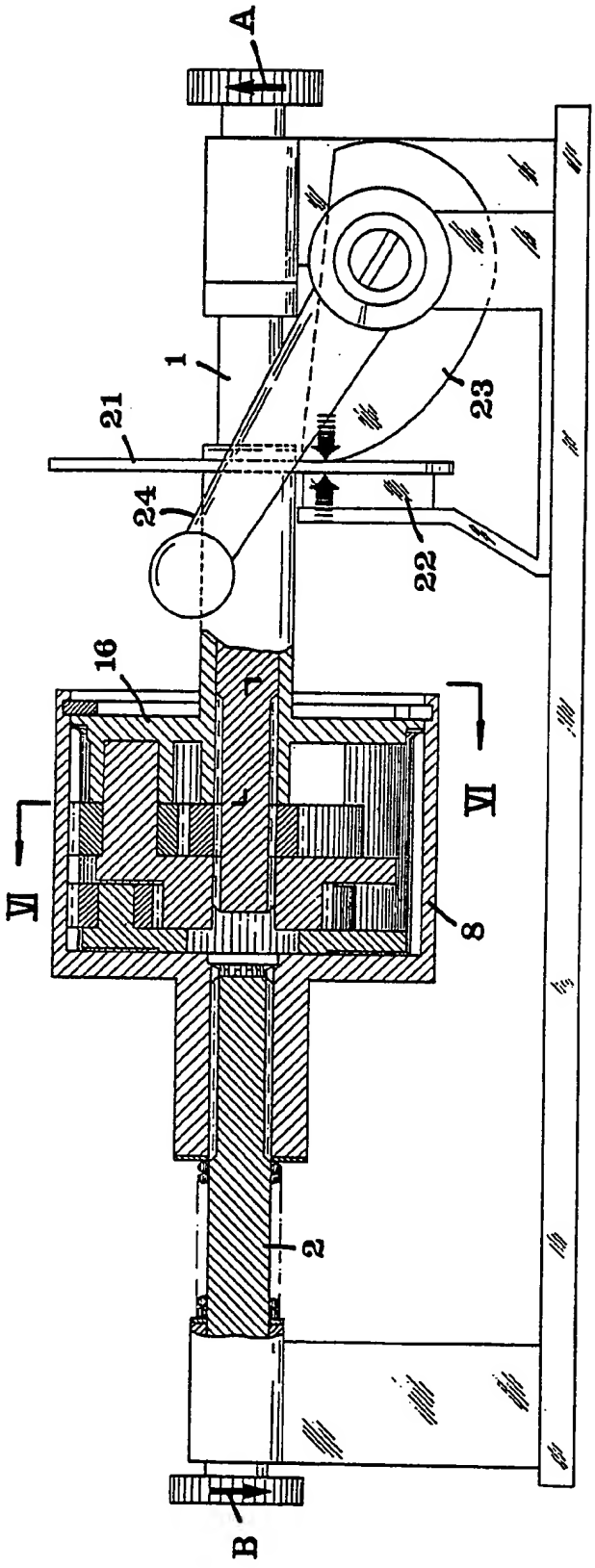


Fig 5

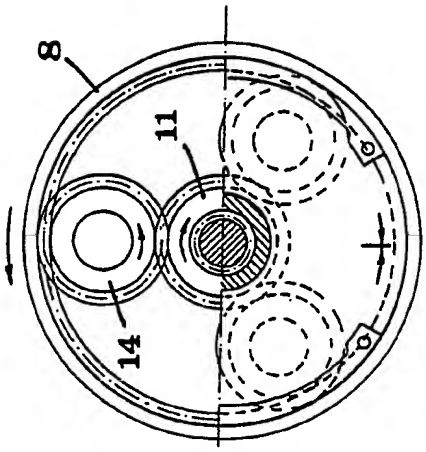
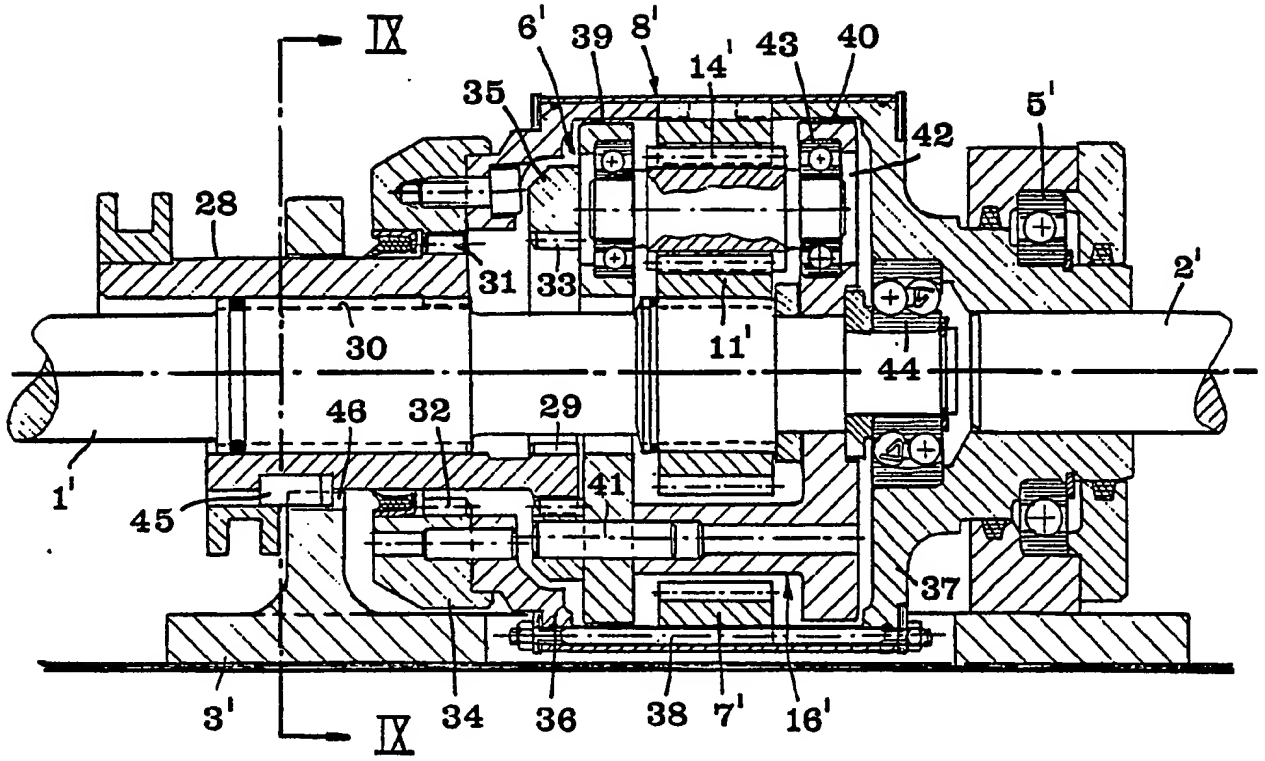


Fig 6

Fig 7


IX
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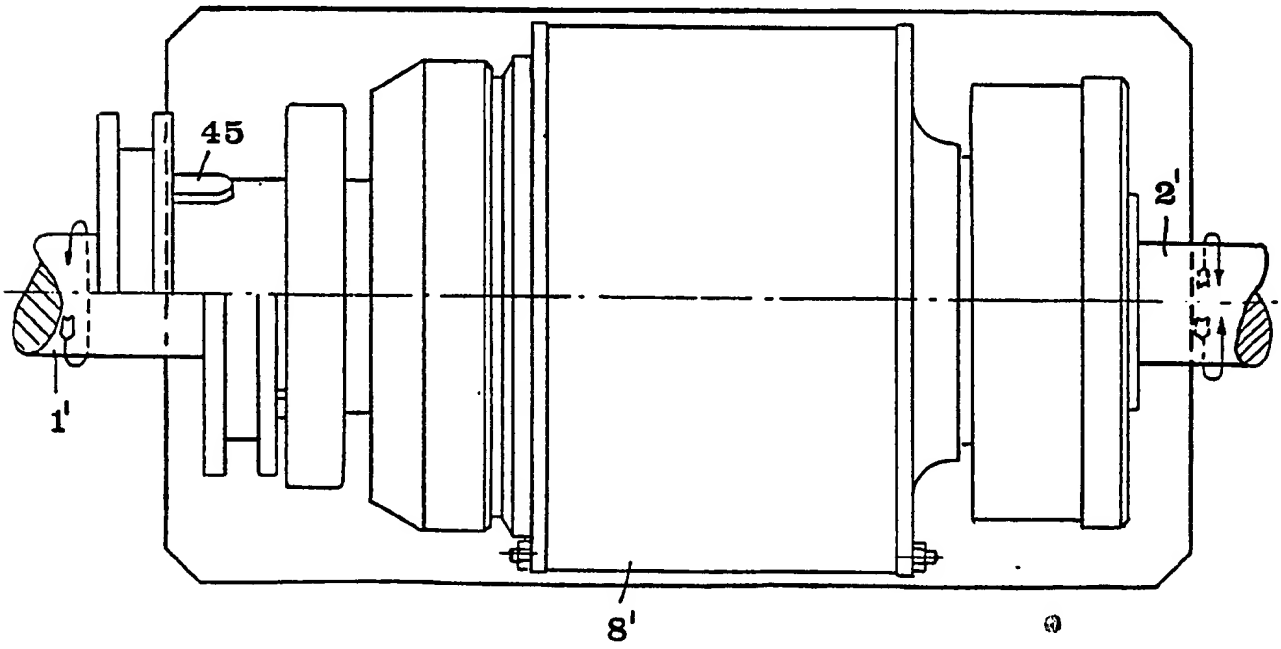
39
8'
14'
43
40
35
5'
42
28
31
33
2'
30
11'
44
46
32
29
1'
41
45
37
3'
34
36
38
7'
16'
IX

Fig 8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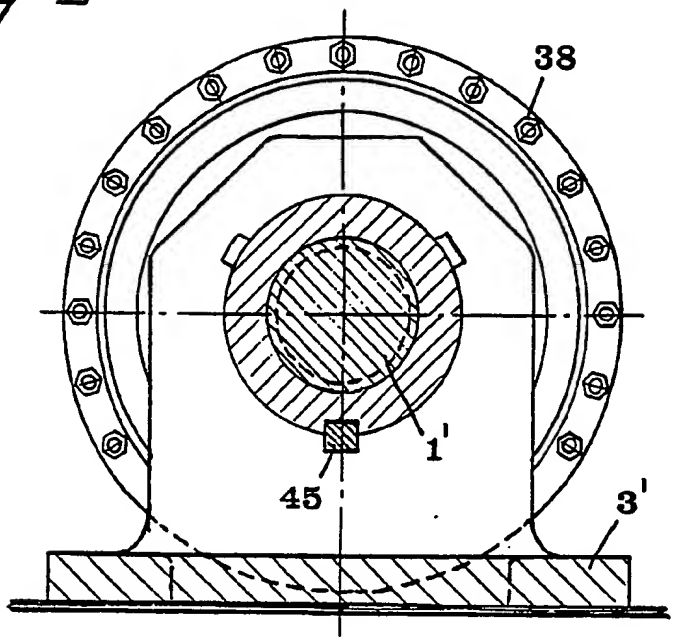
2'
1'
8'

Fig 9



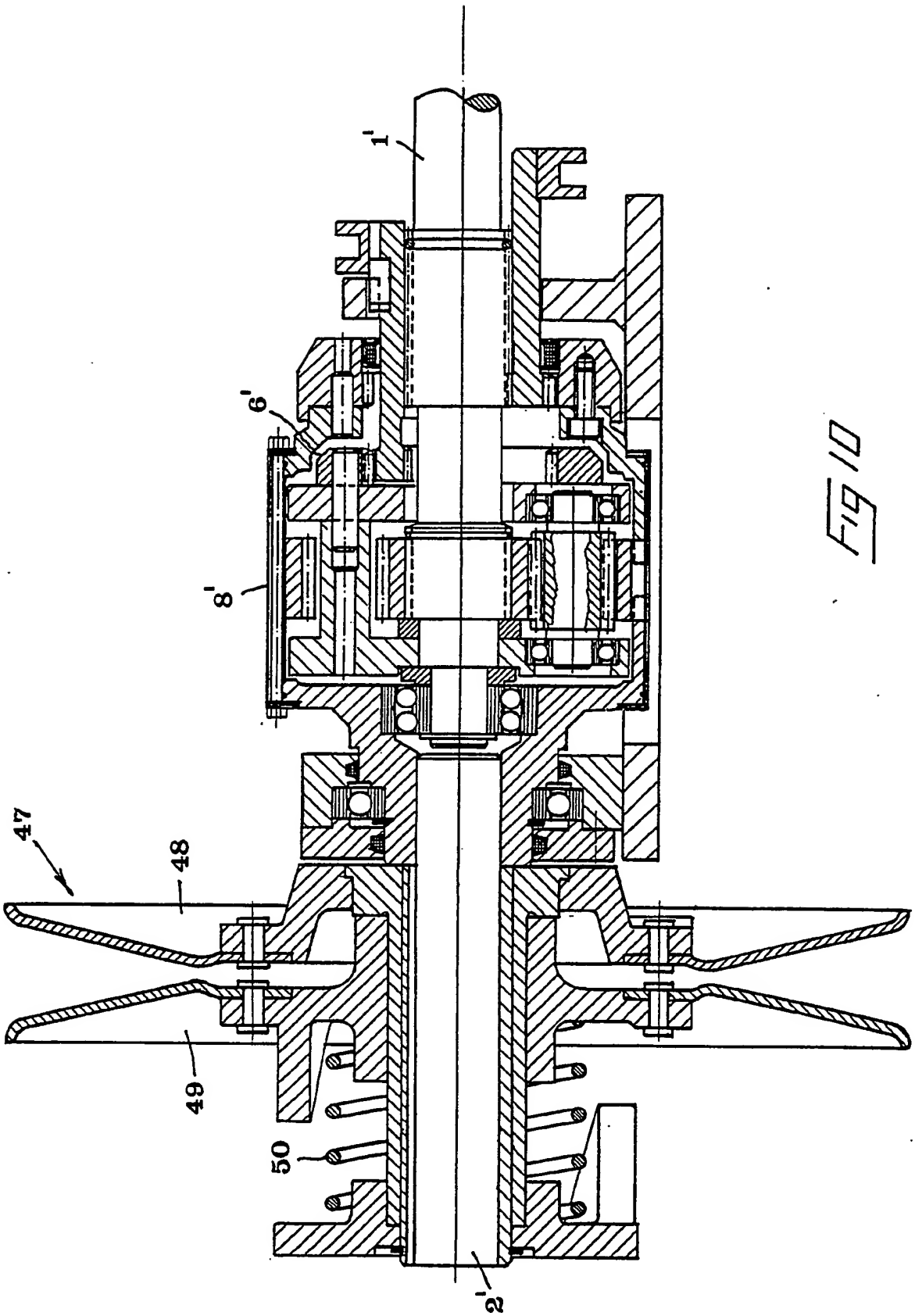


Fig 10

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE86/00222

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC4

F 16 H 3/60

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC	F 16 H 3/00, /60; B 63 H 23/08
US Cl	74:776, 780, 784, 788, 792

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [9]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
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A	SE, A, 8304565-8 (P. H. L. THIGER) 24 February 1985	

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
1986-08-06	1986 -08- 07
International Searching Authority	**Signature of Authorized Officer**
Swedish Patent Office	Per-Olof Vambo

L.E

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